



« Establishing a Generic and Multidimensional Measurement Repository in CMMI Context »



*28th Annual NASA Goddard
Software Engineering Workshop*



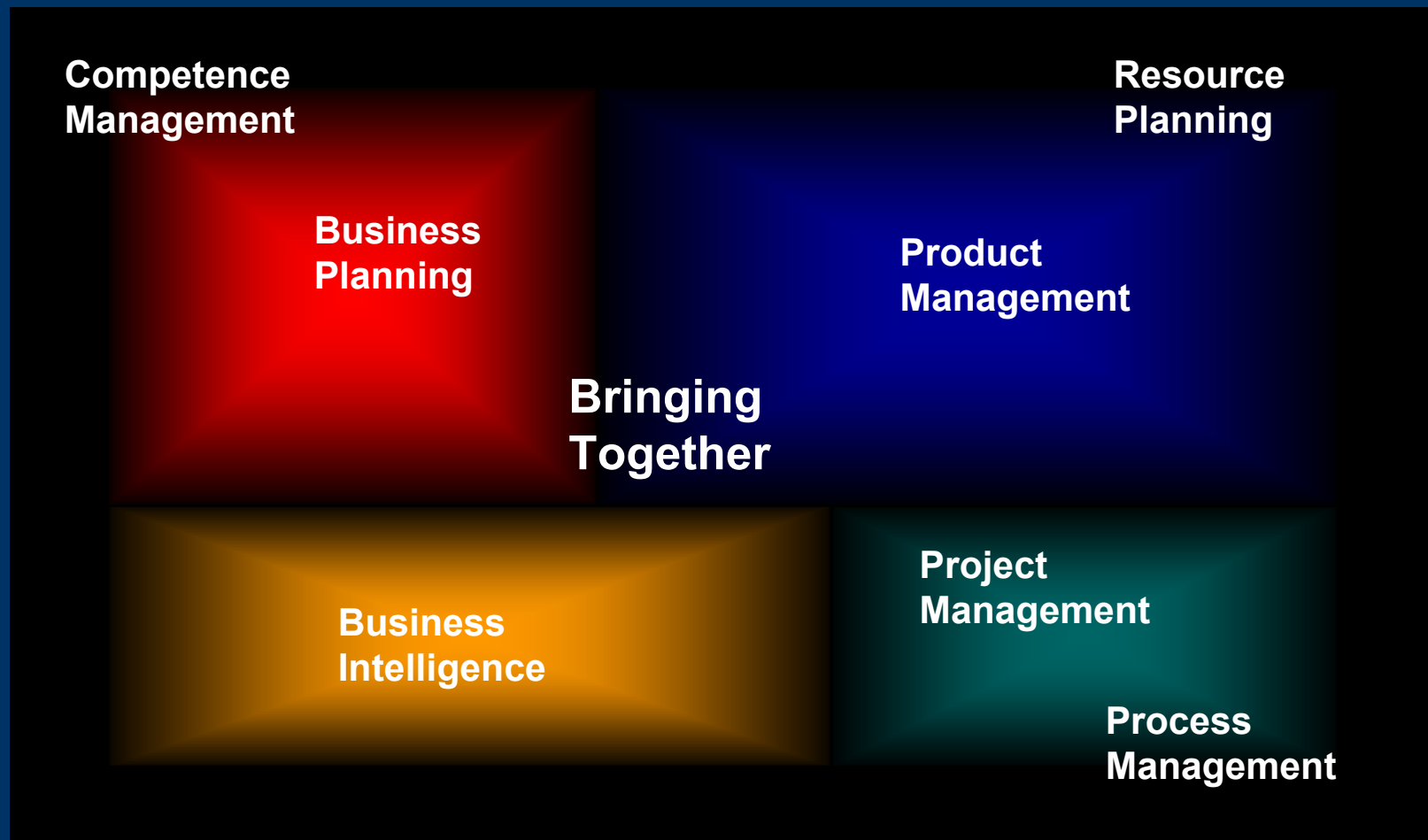
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ÉTS - Software Engineering Research Laboratory

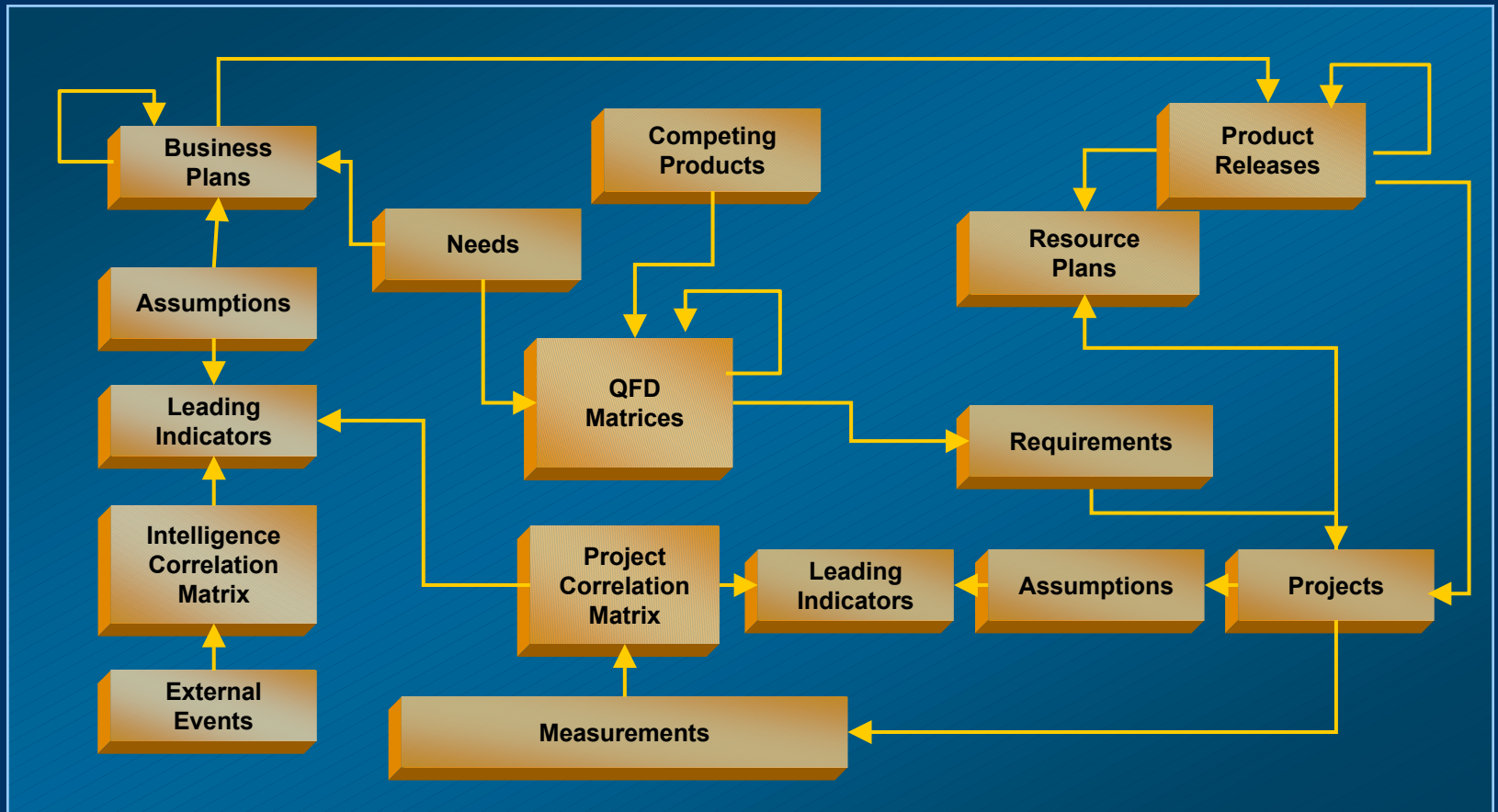
Overview

- Introduction and Objectives
- Criteria, Constraints and Business Indicators
- Measurement Repository Design
- Software Infrastructure
- Conclusion

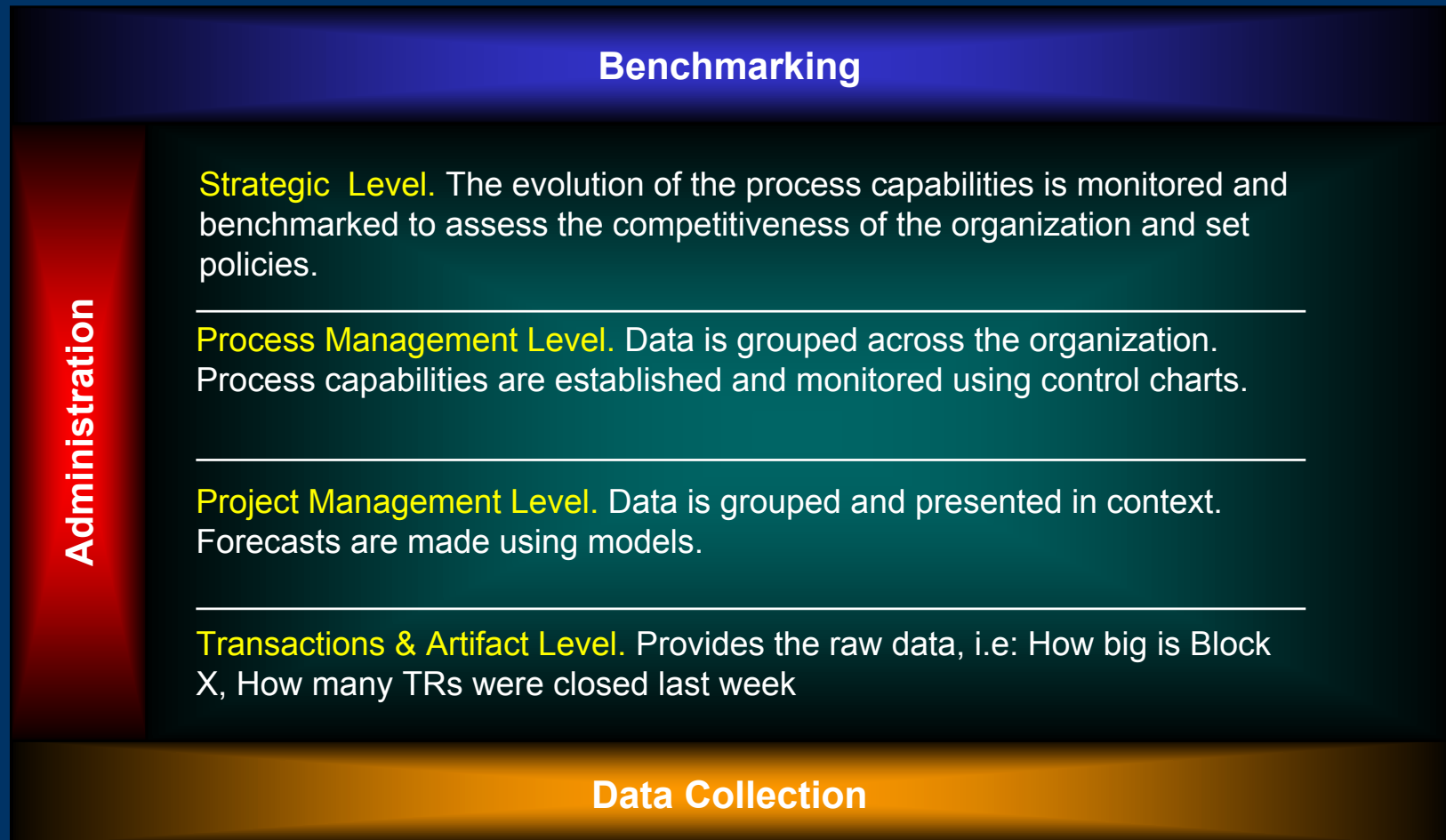
Ericsson's original view



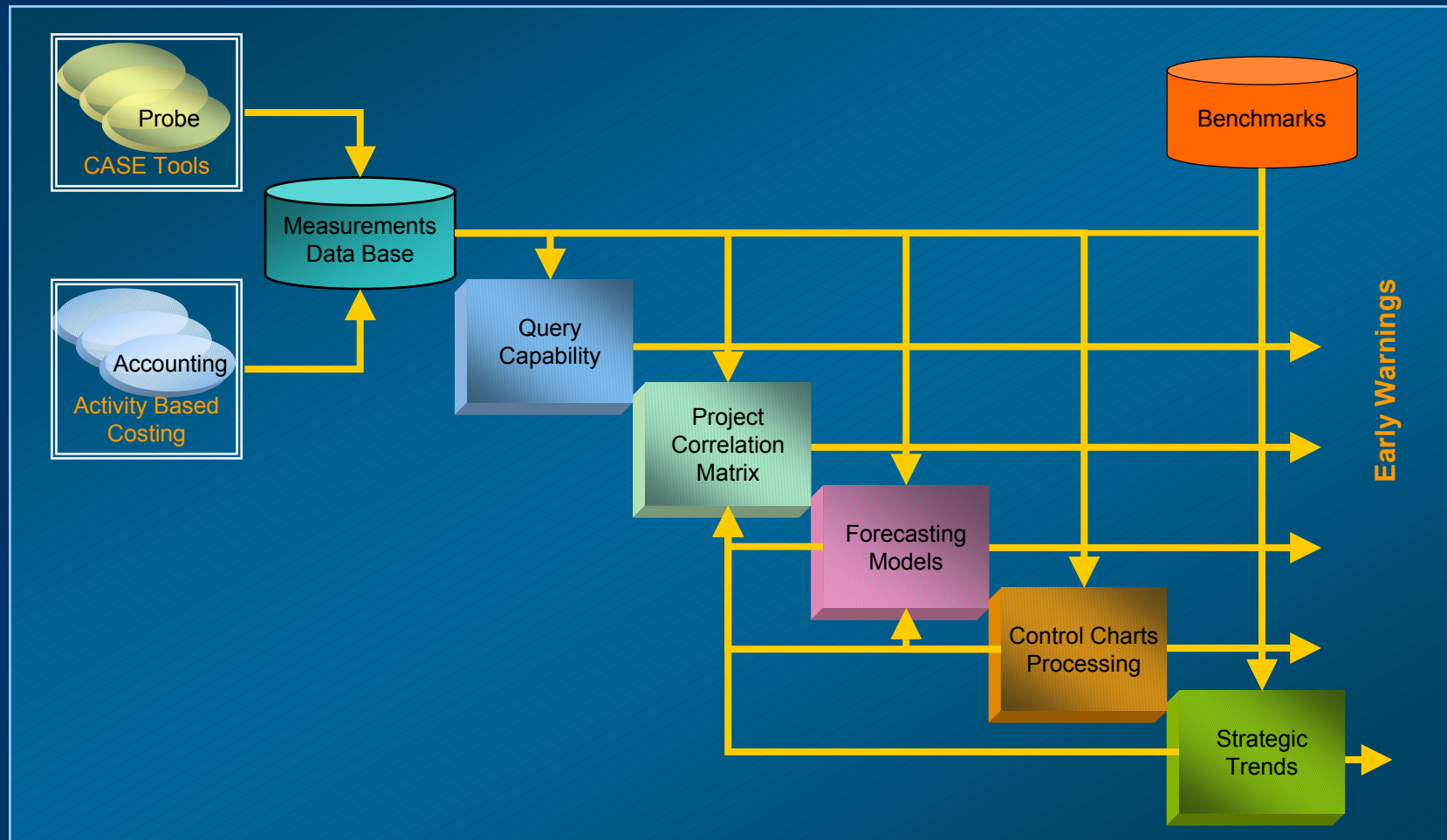
Proposed Business Model



Measurement Foundation



Measurements - Information flow

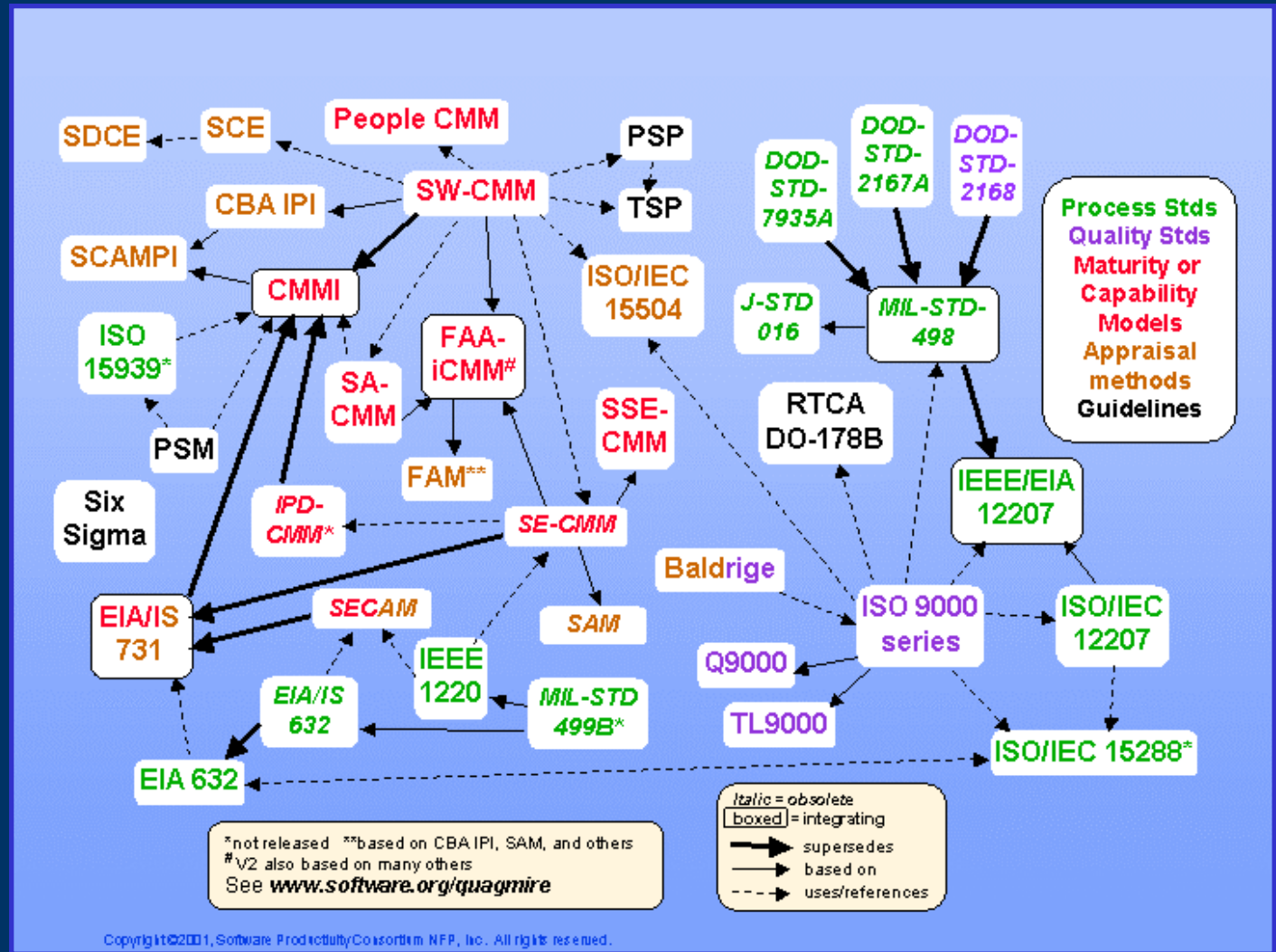


Measurement and CMMI

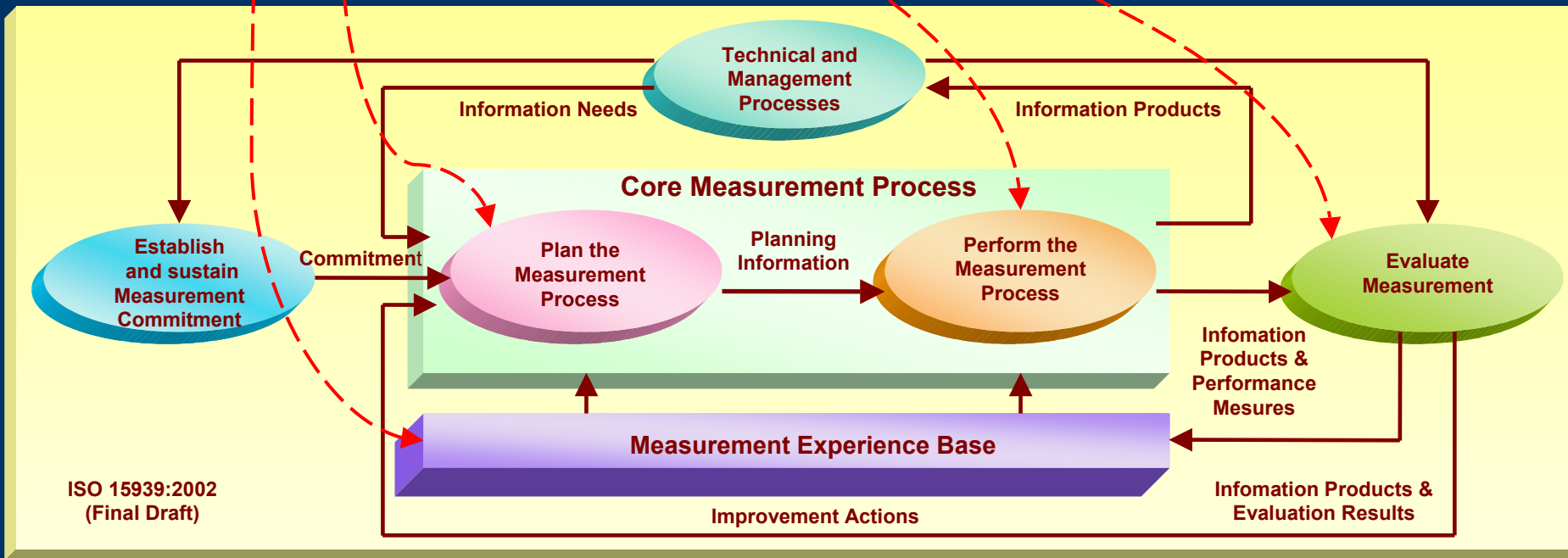
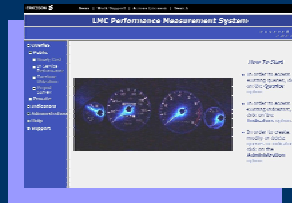
- Maturity level 2 establishes the **Measurement and Analysis Process Area** specifying objectives, data collection, storage, analysis and reporting of Measures (for project planning, estimating and tracking)
- Maturity level 3 specifies the establishment and maintenance of the **Organization's Measurement Repository**. The Repository contains both **product and process measures** that are related to the Organization's Set of Standard Process (OSSP) *.
- Maturity level 4 specifies usage of the measurements to establish the **quantitative foundation** for evaluating organization projects' processes and products.
- Maturity level 5 specifies a continuous process improvement based on a **quantitative understanding** of organization's quality and process performance

** Analogous to ISO9001 Quality Manual*

Frameworks quagmire



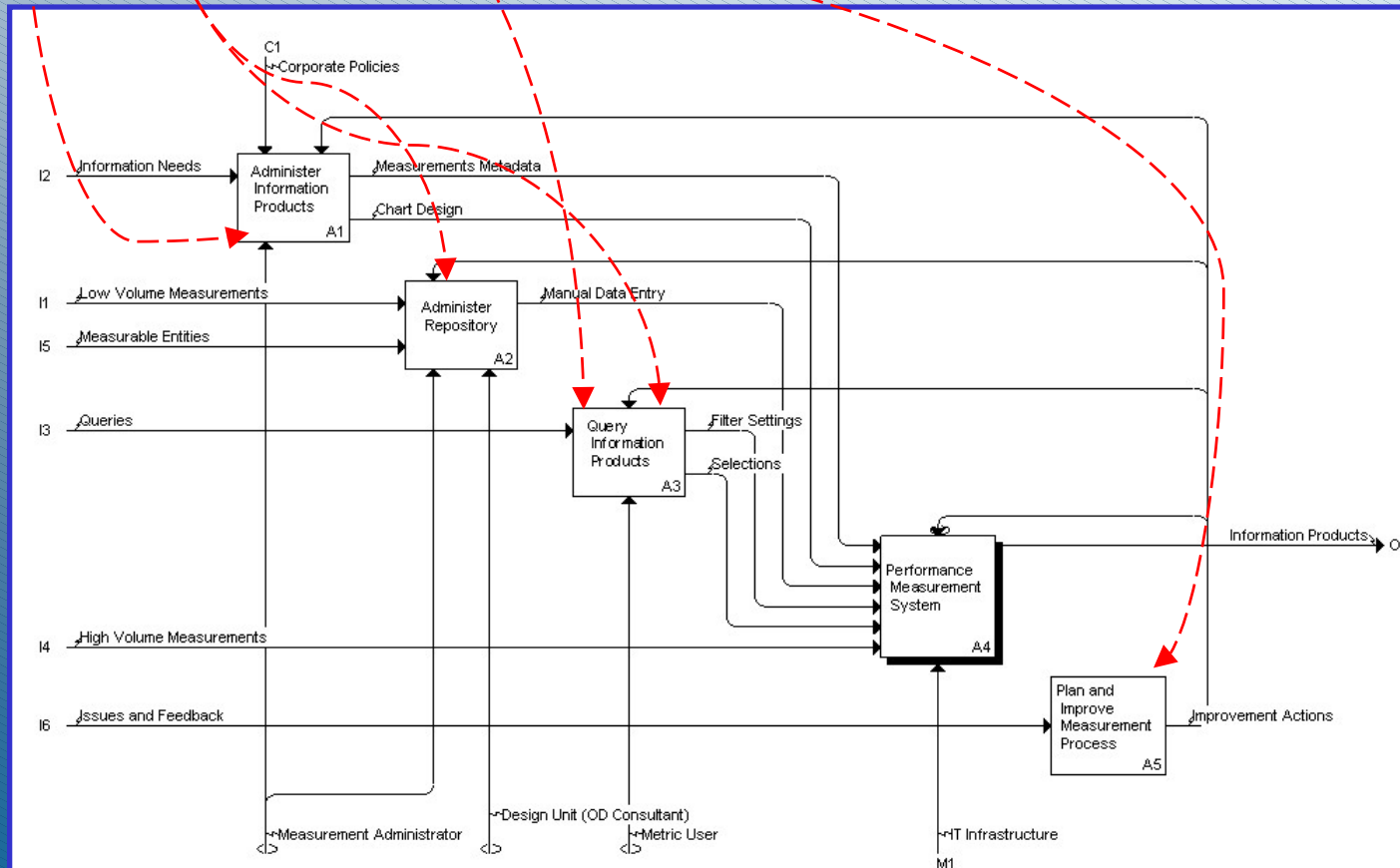
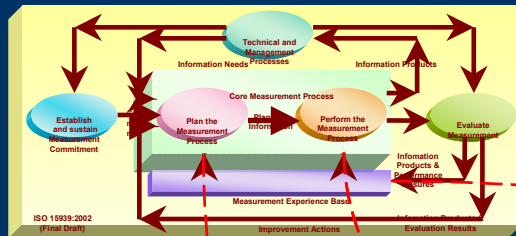
Measurement Repository



Legend



Mapping ISO 15939 to Ericsson Measurement Process



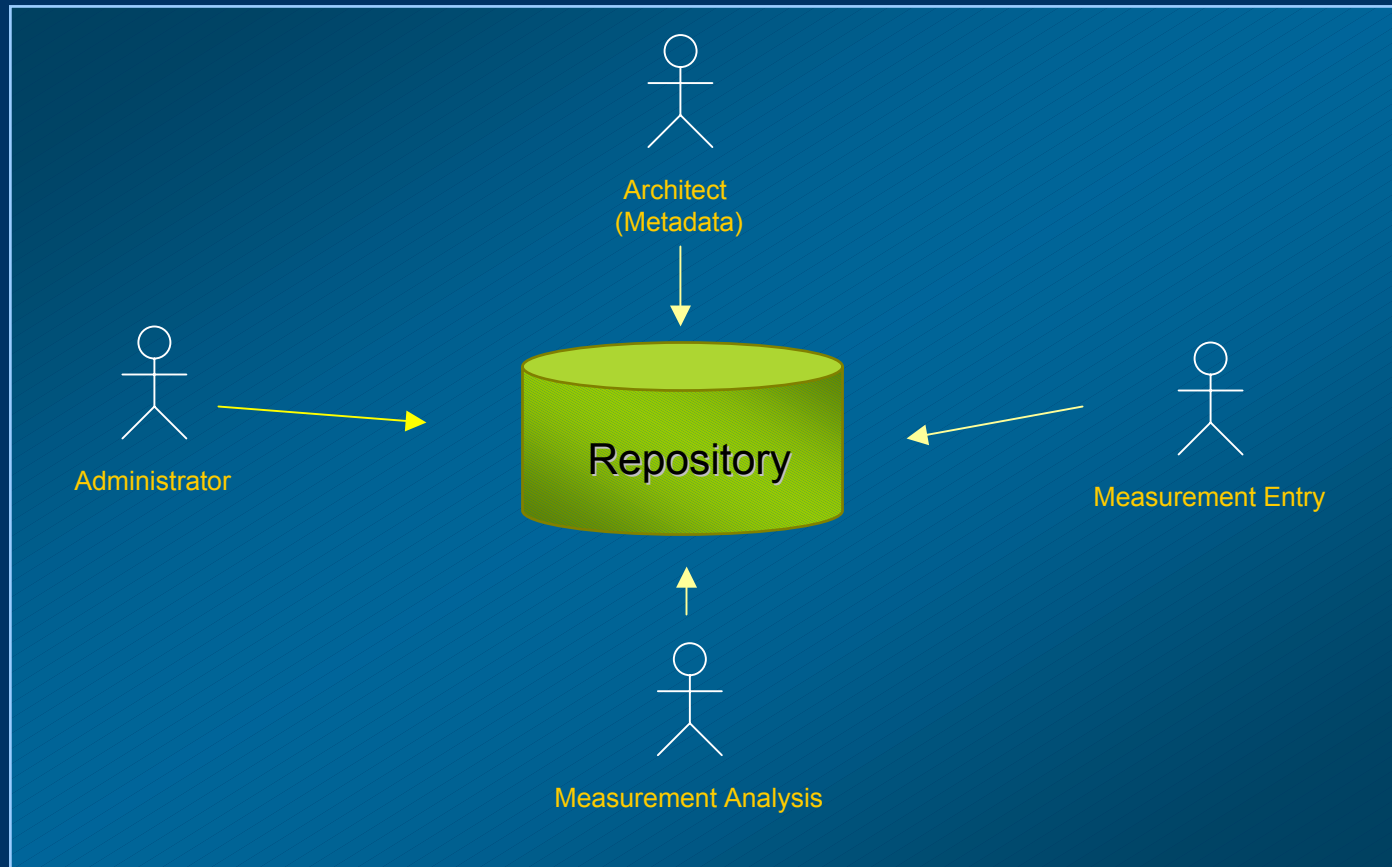
Measurement Repository Design

- The Measurement Repository consists of a collection of **Multidimensional data cubes** (i.e. OLAP cubes) containing the **aggregation data** on which multidimensional measurement analysis is based.
- The repository structure does **not presuppose any particular measures** or relationship between them, but rather that **the measures themselves are treated as data**.
- The data that defines the **measures** and the relationships stored in the repository is called **metadata**.
- OLAP multidimensional capabilities are used for defining **several components of the Measurement Repository**, such as: Entities, Aggregations, Series, Attributes, Categories, etc.

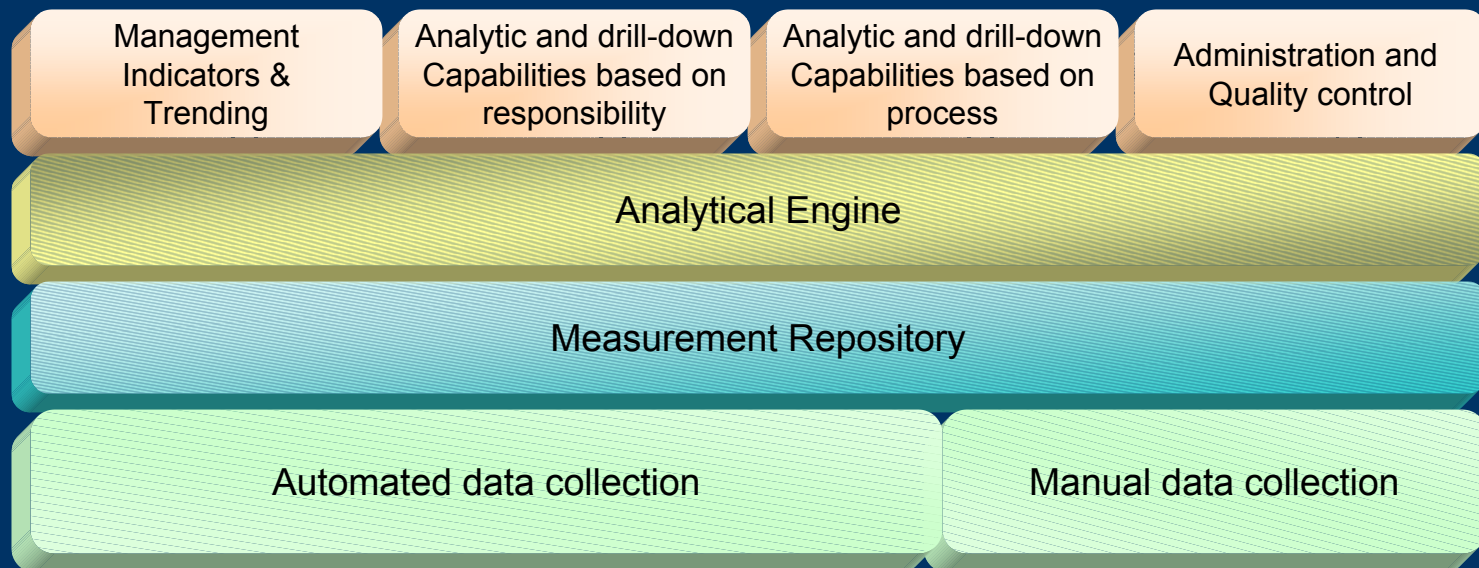
Measurement Repository Design (*continued*)

- The OLAP services pull together data from **multiple sources** in the organization and store that data in a form convenient for further analysis and **decision support**.
- OLAP cubes are materialized views of information, that is, a way of **pre-computing data summaries** so that requests can be answered quickly
- OLAP technology provides for **graphical representation of multidimensional measures** of the Measurement Repository (drill-down, roll-up).
- The system architecture of the repository will only store **base measurements**. **Derived measurements** will be handled by the “Analytical Engine” (ex. MS-Analysis Services).

Measurement Repository: Interaction Roles

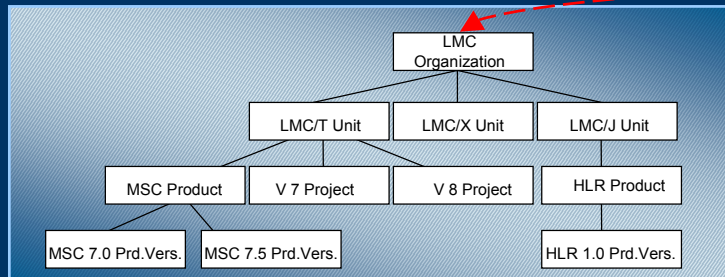


Measurement System Repository: Internal Architecture

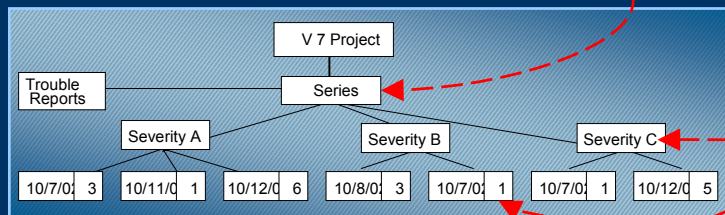


Object Oriented Repository Data Model

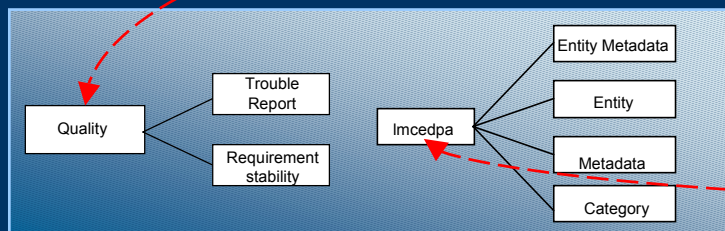
Relationship Hierarchy among entity instances supported by the Aggregates relationship



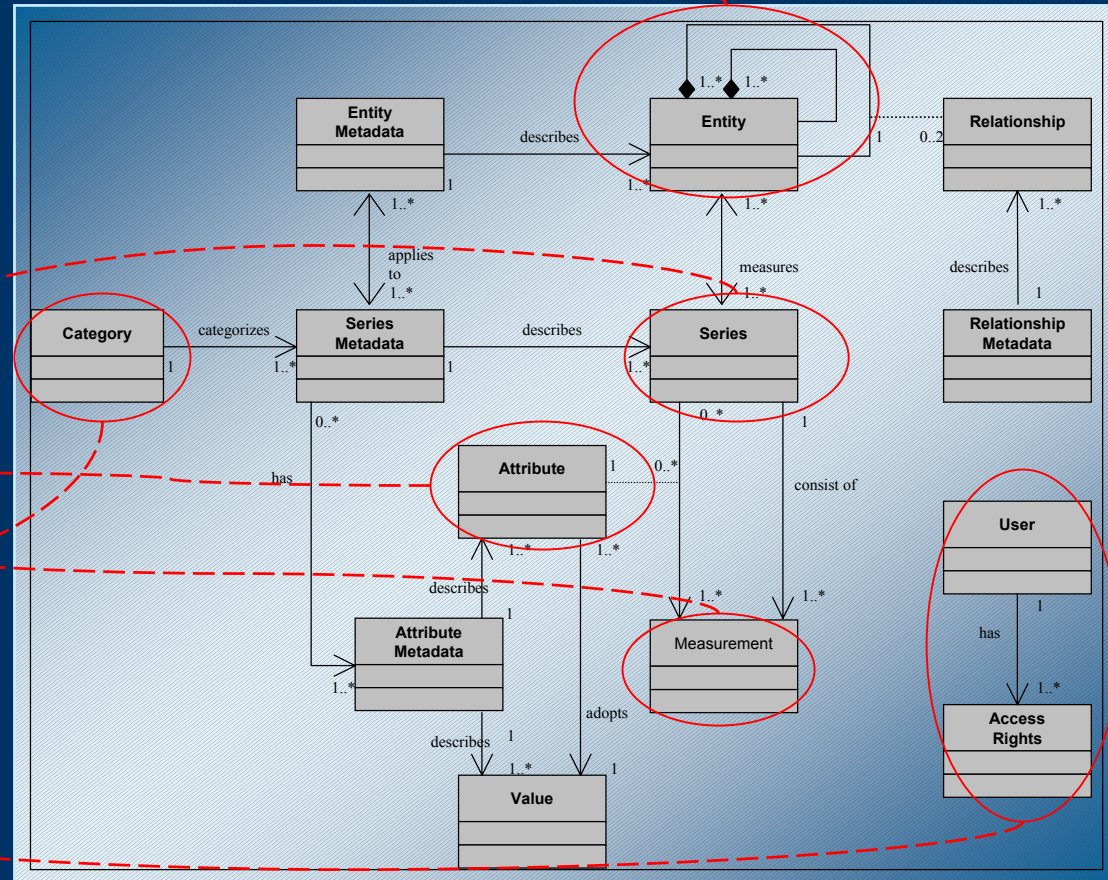
Measurement qualification



Categories



Security mechanisms

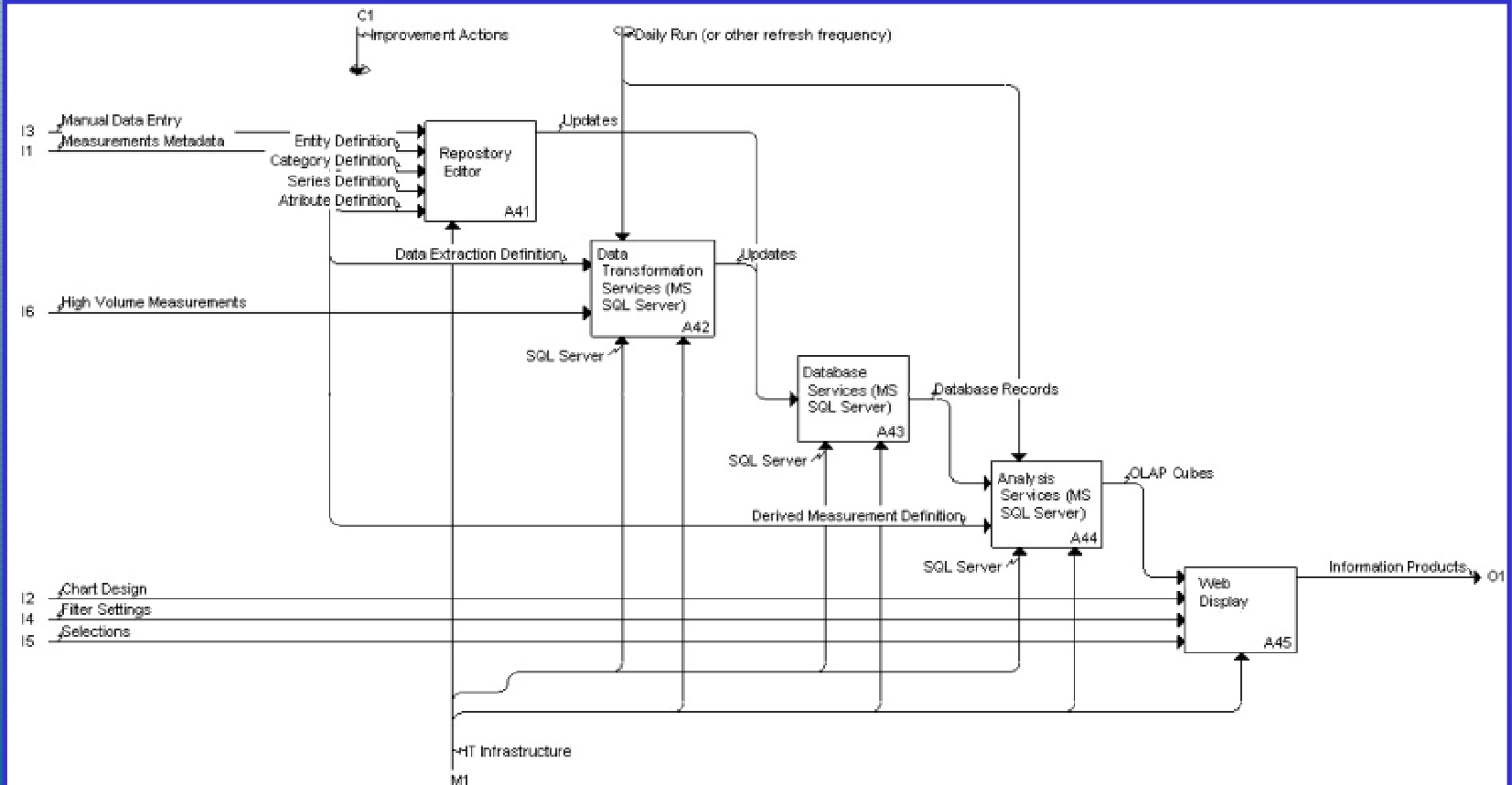


Software Infrastructure

- MS Windows 2000 Server
- MS SQL 2000 Server
- MS Analysis Services Enterprise Edition
- MS Internet Information Server
- ASP technology and Pivot Table Services (PTS)
- Intranet Share Portal Server*

** Next phase*

Measurement System Repository: Data flow



Measurement Data Collection

Metrics Editor | [Administration](#)

Home » Connections » metricsRep » Table: [Measurement] DB Admin (logout)

Measurement 1109 records Add Record

Page 1 of 222 Show 5 records per page

Action	MeasurementID	Series Id	Time Stamp	Entity	DateOfLastEntry	VersionNumber	SecurityKey
	12	18	1/8/2002			0	
	13	18	1/15/2002	47.5		0	
	14	18	1/22/2002	47.5		0	
	15	18	2/12/2002	47.5		0	
	17	18	2/19/2002	84.75		0	

Check All Uncheck All Delete Selected

Export to Excel Export to XML

Metrics Editor | [Administration](#)

Home » Connections » metricsRep » Table: [Fact_table_PerformanceIndex] DB Admin (logout)

Fact_table_PerformanceIndex 24 records Add Record

Page 1 of 3 Show 10 records per page

Action	MeasurementID	SeriesType	Entity Id	Time Stamp	NumericValue
	1300	9	30	3/19/2002	1
	1301	9	30	7/11/2002	1.122
	1302	9	30	10/30/2002	1.33
	1303	10	30	3/19/2002	1
	1304	10	30	7/11/2002	0.888
	1305	10	30	10/30/2002	0.777
	1306	9	29	6/14/2002	1
	1307	9	29	7/8/2002	1.22
	1308	9	29	8/2/2002	1.33
	1309	9	29	9/9/2002	1.44

Check All Uncheck All Delete Selected

Export to Excel Export to XML

Metrics Editor Metrics Editor » Edit Record - Microsoft Internet Explorer provided by Ericsson LMC

metricsRep » Table [Measurement] » Edit Record

MeasurementID Auto Increment (12)

SeriesId 18 - 1

TimeStamp 1/8/2002

NumericValue 75

DateFirstEntry

DateOfLastEntry

VersionNumber 0

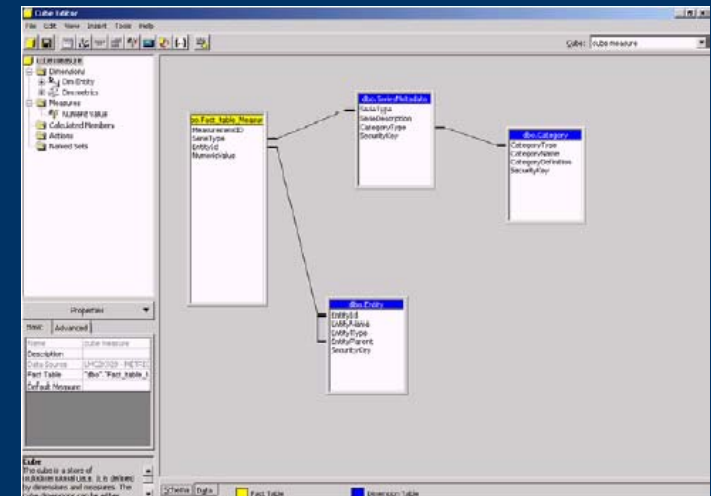
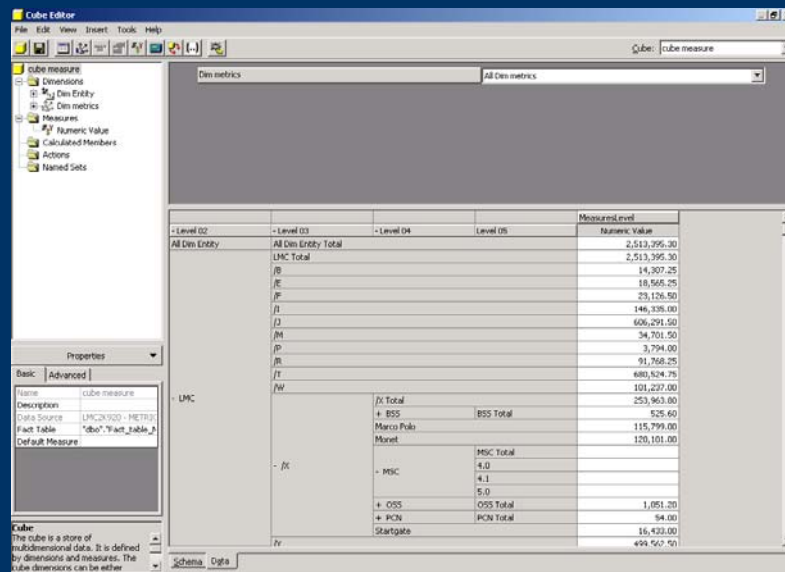
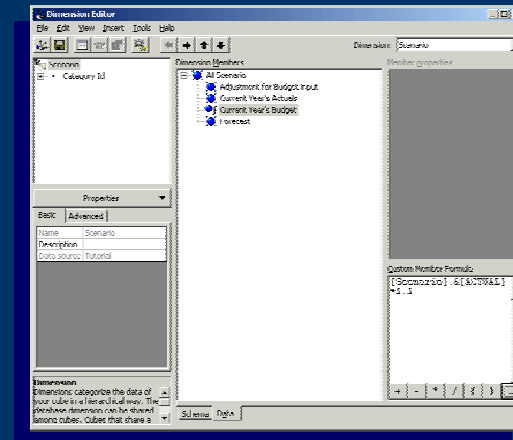
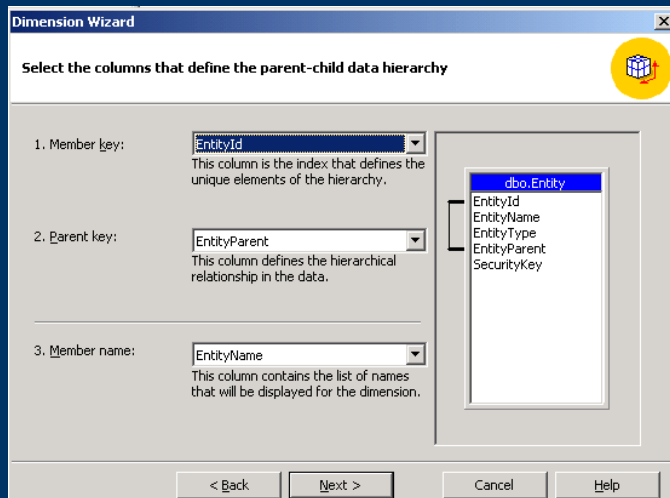
SecurityKey

Save Close

Check All Uncheck All Delete Selected

Export to Excel Export to XML

OLAP Cubes construction



Fact Table Earn Value

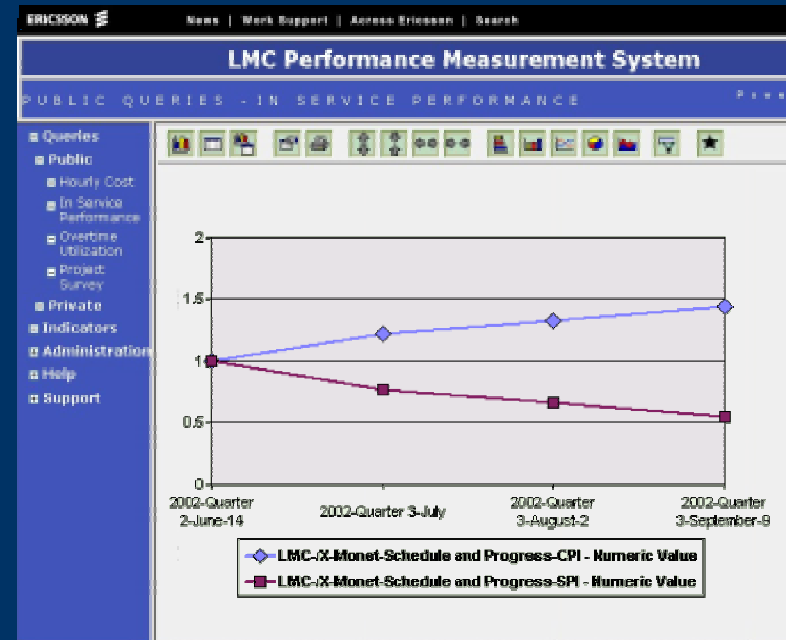
```

INSERT INTO Fact_Table_EarnedValue
SELECT
MNT.MeasurementID, SE.SerieType, EN.EntityId, MNT.[TimeStamp], MNT
.NumericValue
FROM Entity En, Measures ME, Series SE, SeriesMetadata
SM, Measurement MNT
WHERE (EN.EntityId=ME.EntityId)
AND (ME.SerieId=SE.SerieId )
AND (SM.SerieType =SE.SerieType)
AND (MNT.SerieId=ME.SerieId)
AND ((SM.SerieType ='4')or(SM.SerieType ='5')or(SM.SerieType ='6'));
```

Fact Table Performance Index

```

INSERT INTO Fact_Table_PerformanceIndex
SELECT
MNT.MeasurementID, SE.SerieType, EN.EntityId, MNT.[TimeStamp], MNT.Nu
mericValue
FROM Entity En, Measures ME, Series SE, SeriesMetadata SM, Measurement
MNT
WHERE (EN.EntityId=ME.EntityId)
AND (ME.SerieId=SE.SerieId )
AND (SM.SerieType =SE.SerieType)
AND (MNT.SerieId=ME.SerieId)
AND ((SM.SerieType ='9')or(SM.SerieType ='10'));
```

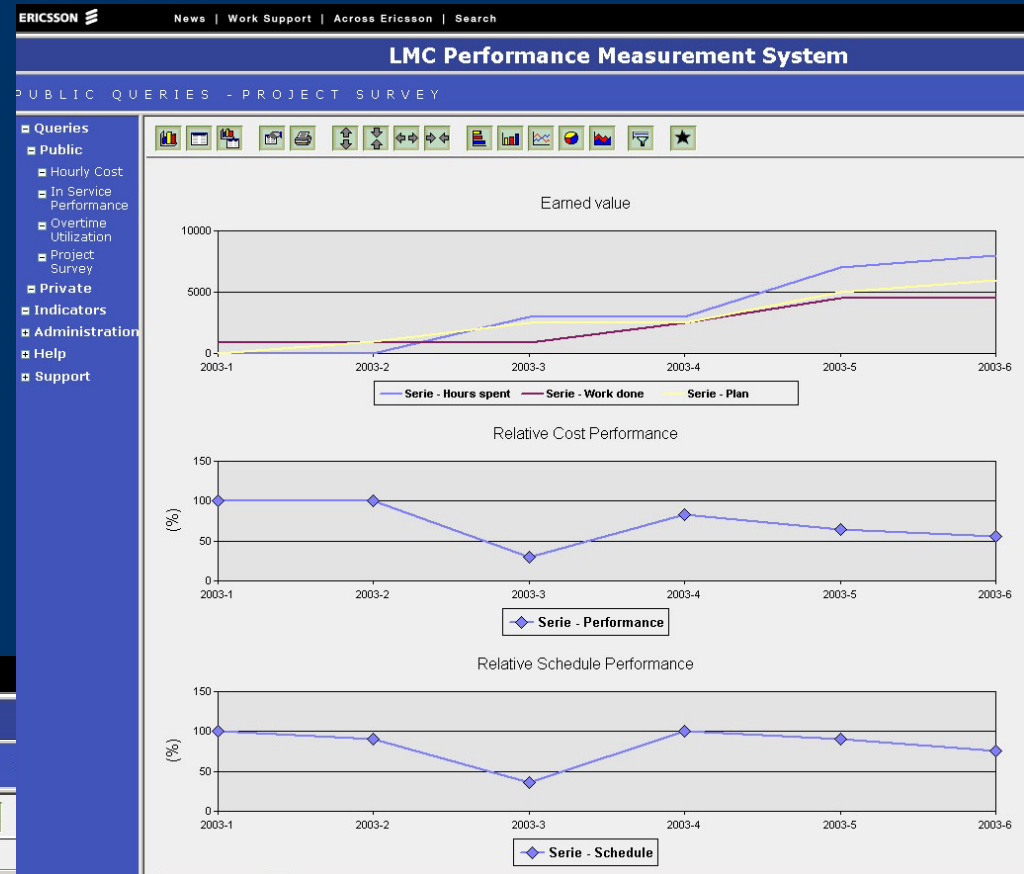
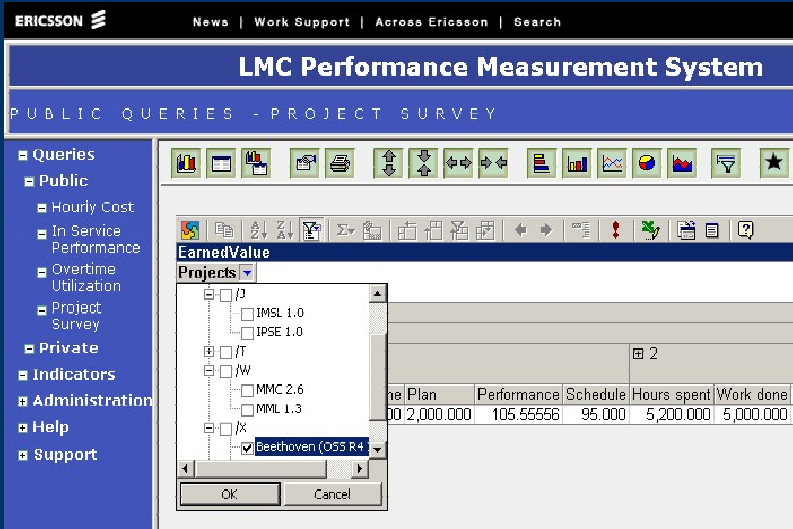
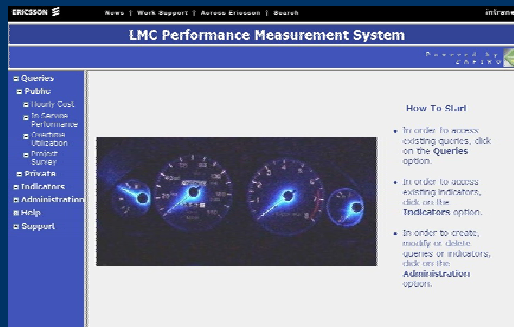


Drop Filter Fields Here

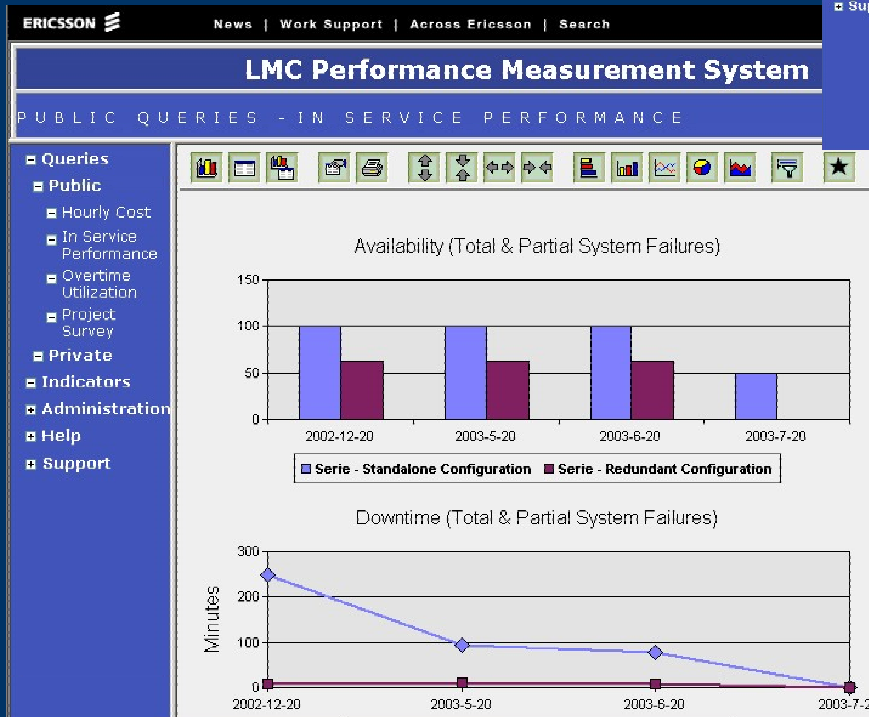
Year	Quarter	Month	Day
2002			
	Quarter 2	Quarter 3	
	June	July	
	14	2	

Level 02	Level 03	Level 04	Category Name	Serie Description	Numeric Value	Numeric Value N
LMC	X	Monet	Schedule and Progress	CPI	1.000	1.22000
				SPI	1.000	.77000

Measurement Representation



OLAP Cubes Manipulation



ERICSSON News | Work Support | Across Ericsson | Search

LMC Performance Measurement System

NEW QUERY by Z A

- Queries
 - Public
 - Hourly Cost
 - In Service Performance
 - Overtime Utilization
 - Project Survey
 - Private
 - Indicators
 - Administration
 - Queries Administration
 - Indicators Administration
 - Help
 - Support

Available Cubes:
- In Service Performance

In Service Performance

Drop Filter Fields Here

Drop Column Fields Here

Drop Row Fields Here

Drag items to the Pivot table list

- Totals
 - Availability Psf Rd
 - Availability Psf Rd Time
 - Availability Psf Sd
 - Availability Psf Sd Time
 - Availability Tsf Rd
 - Availability Tsf Rd Time
 - Availability Tsf Sd
 - Availability Tsf Sd Time
 - Downtime Psf Rd
 - Downtime Psf Rd Time
 - Downtime Psf Sd
 - Downtime Psf Sd Time
 - Downtime RD
 - Downtime RD Time

PivotTable Property Toolbox

General

Selection: None

Show/Hide

Title bar:

Toolbar:

Field list:

Expand indicators:

Drop areas:

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LMC Performance Measurement System

PUBLIC QUERIES - IN SERVICE PERFORMANCE

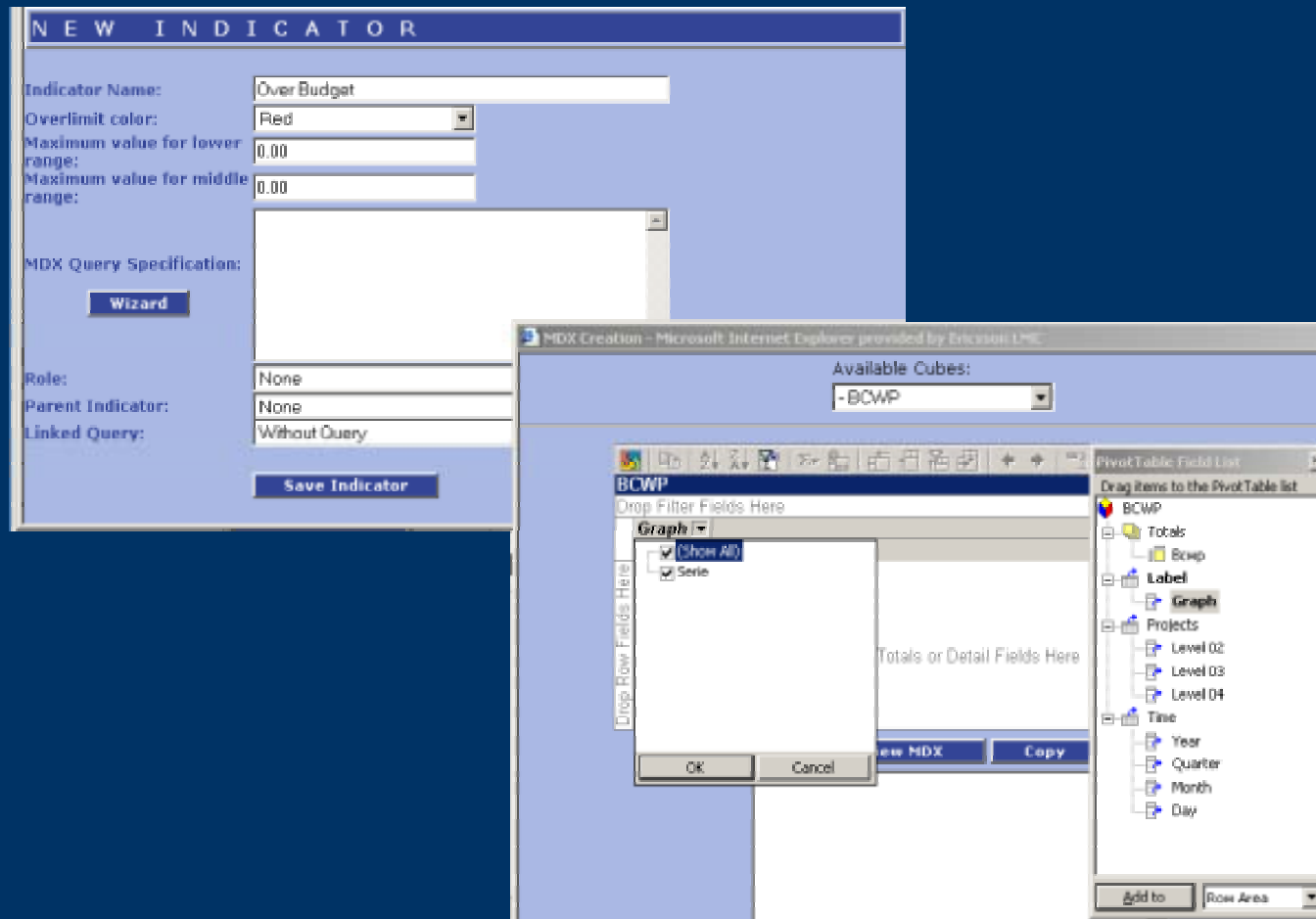
- Queries
 - Public
 - Hourly Cost
 - In Service Performance
 - Overtime Utilization
 - Project Survey
 - Private
 - Indicators
 - Administration
 - Queries Administration
 - Indicators Administration
 - Help
 - Support

cube measure

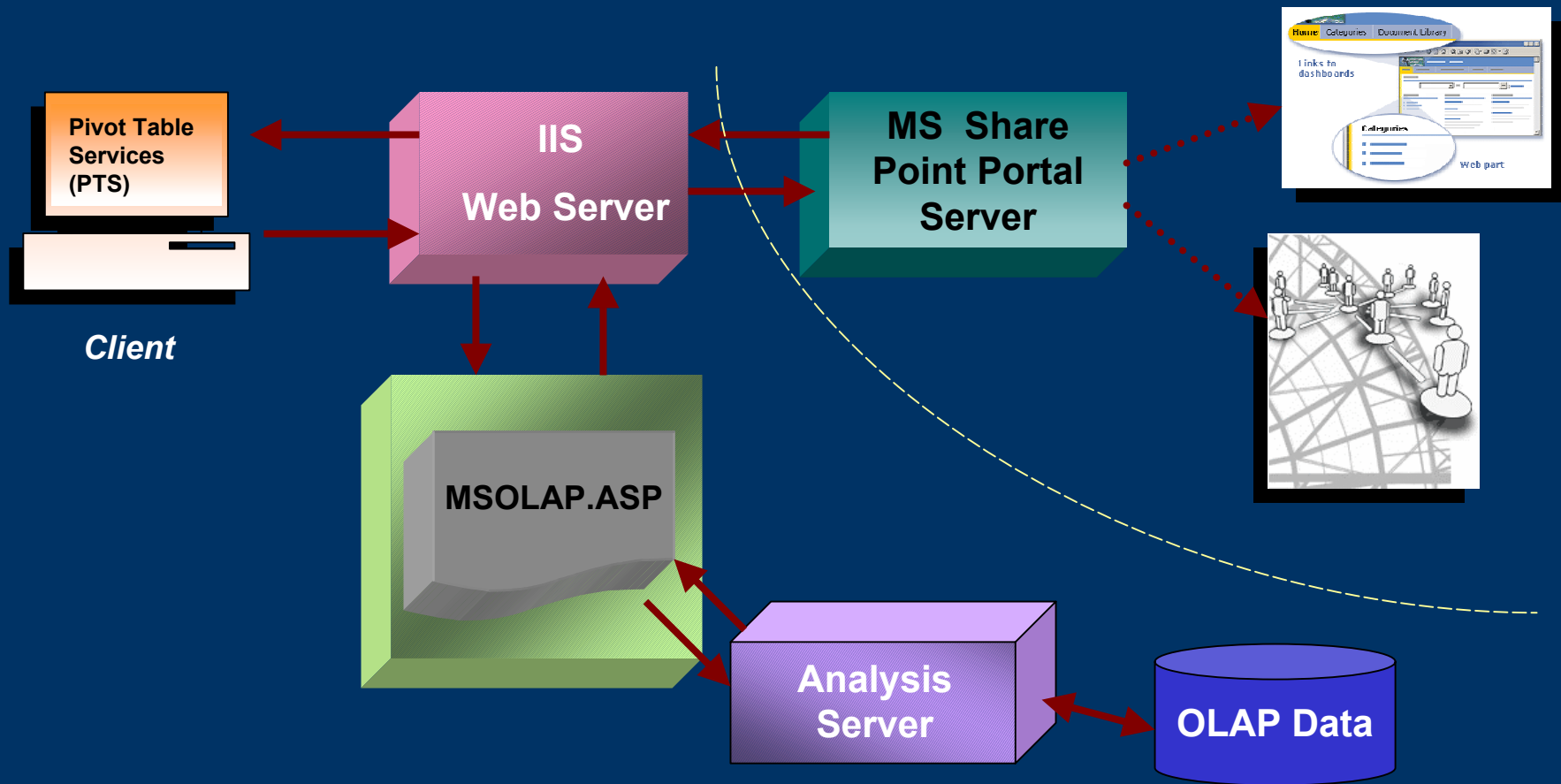
Drop Filter Fields Here

Level 02	Level 03	Level 04	Level 05	Category Name	Numeric Value
LMC	/B				14,307.25000
	/E				18,565.25000
	/F				23,126.50000
	/A				146,335.00000
	/J				606,291.50000
	/M				34,701.50000
	/P				3,794.00000
	/R				91,768.25000
	/T				680,524.75000
	/W				101,237.00000
	/X				525.60000
	BSS				525.60000
	Marco Polo	Total			115,799.00000
	Monet	Total			120,101.00000
	OSS		R3.1	Product Quality	525.60000
			Total		525.60000
			R3.3	Product Quality	525.60000
			Total		525.60000
			Total		1,051.20000
	PCN		R3.3	Product Quality	27.00000
			Total		27.00000
			R3.4		27.00000

Indicators construction



Measurement Communication over the Ericsson Portal Server *(Next phase)*



Conclusion

- Multidimensional Metadata + PSM + ISO 15939
= Excellent support for CMMI levels 3 to 5
- Development support challenge (MS Analysis Services)

References

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Merci !!!

Questions ?

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